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ABSTRACT

This module on the genitourinary system is one of 17 modules designed for individualized instruction in health occupations education programs at both the secondary and postsecondary levels. It is part of an eight-unit miniseries on anatomy and physiology within the series of 17 modules. Following a preface which explains to the student how to use the module, the unit consists of a pretest with answers, three sections (information sheets) with their objectives (e.g., identify and describe the location and anatomical structure of the kidneys), optional activities (e.g., research the process of dialysis by an artificial kidney machine), and posttests, and a glossary of terms. Topics covered in the unit are introduction to the genitourinary system, the urinary system, and the male reproductive system. An accompanying instructor's guide contains suggestions for using the module and answers to the posttest. (KC)

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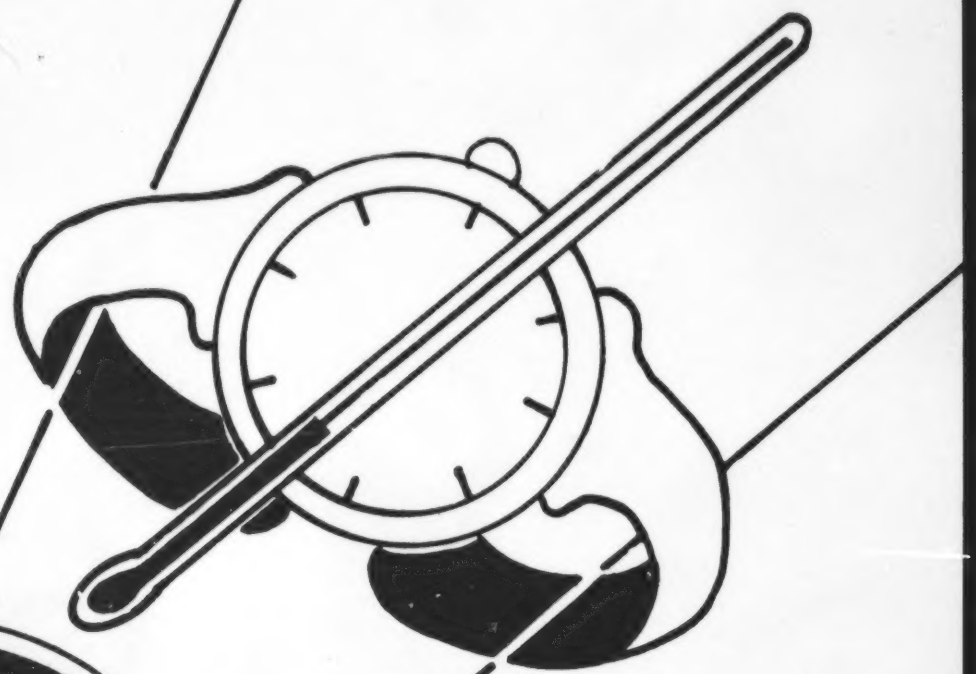

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THE GENITOURINARY SYSTEM

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Instructional Materials in Anatomy and Physiology
for Pennsylvania Health Occupations Programs

THE GENITOURINARY SYSTEM

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June, 1980

PREFACE

An understanding of basic human anatomy and physiology is essential to any person preparing to enter a health occupation. This instructional unit is designed to introduce you to the structures and functions of the human genitourinary system--and the interrelationships of the two--and to familiarize you with some of the terms and concepts necessary for an understanding of the genitourinary system.

This unit consists of a pretest, three modules with their optional activities, a glossary of terms, and a post-test.

Begin this modular unit by taking the brief pretest at the front of the booklet. Write your answers on a sheet of paper and pass it to your instructor.

Next, read through each of the modules (Introduction to the Genitourinary System, The Urinary System, and the Male Reproductive System) and investigate any of the optional activities that may be helpful or interesting to you. The optional activities will help you learn more about some of the materials presented.

At the end of this unit is a glossary which provides you with brief definitions of many of the terms used in the modules.

Upon completion of this unit, you should be able to demonstrate an understanding of the material presented by your performance on the post-test. When you have finished this unit, and feel that you understand the information presented, take the post-test that follows it. Write down your answers on a sheet of paper and pass it in to your instructor, who will give you your grade.

Genitourinary System
PRETEST

1. The major organs of the urinary system that filter the blood and produce urine are the two:

_____.

2. Name the two organs that are shared by the reproductive system and the urinary system in the male.

_____

_____

3. Name the urinary ducts which transfer urine from the kidneys to the bladder.

_____

4. The bag-like organ that stores urine is the:

A. urethra.
B. ureter.
C. bladder.
D. glumerulus.

5. Urine formation takes place in what microscopic units of the kidneys?

_____

6. The outer layer of the kidney is called the.

   A. nephron.
   B. cortex.
   C. pelvis.
   D. medulla.

7. What is the main function of the urinary bladder?

   _____

8. An important function of the kidneys is maintenance of the body's:

   A. metabolic rate.
   B. hormone production.
   C. water balance.
   D. protein intake.

9. The kidneys are located on the back of the:

   A. chest.
   B. abdomen.
   C. stomach.
   D. thorax.

10. List the two major functions of the testes.

    _____

    _____

11. Which of the following are the male reproductive cells?

    A. spermatozoa
    B. seminal vesicles
    C. ova
    D. epididymides

12. The small tube that connects the ductus deferens to the urethra is the:

_____.

13. The major function of the male reproductive accessory organs is the production and secretion of:

A. hormones.
B. urine.
C. sperm.
D. seminal fluid.

14. What is the male reproductive accessory organ that surrounds the urethra and ejaculatory ducts?

_____

15. Sperm is forcibly expelled from the penis through the process of:

_____.

INTRODUCTION TO THE GENITOURINARY SYSTEM

Objectives

Upon completion of this module, you should be able to:

1. Describe the general organization and functions of the urinary system.
2. Describe the relationships between the urinary system and the male and female reproductive systems.

The body continually takes in materials for use in its normal metabolic processes, and so must continually eliminate the wastes these processes produce. Many routes exist in the body for the disposal of these wastes; the urinary system serves as one of the primary routes. The major organs of the urinary system are the kidneys, whose task is to filter the blood and produce urine; the urinary bladder, which collects and stores the urine; and the urinary ducts, the ureters and urethra, the tubes through which the urine passes on its way out of the system and the body.

The major function of the urinary system is to produce urine and expel it from the body. But in performing this basic function, it performs other functions vital to the body. Since the waste products which become urine are filtered out of the blood supply, the urinary system also cleans out the circulating blood. This protects the body from poisoning itself with the waste products of normal metabolic processes. The urinary system can exert a great influence over the body's internal state simply through its effect on the contents of the blood. By controlling the amount and concentration of substances that are eliminated, the urinary system helps maintain the body's homeostasis.

The urinary and reproductive organs are often discussed as a single system, the genitourinary system. A close relationship between the two systems exists, especially in the male. Two organs of the male external genitalia--the urethra and the penis--perform functions for both systems. For this reason, the male reproductive system will be discussed in this unit. The relationship between the female reproductive and urinary systems is one of proximity only. The two systems lie next to each other in the pelvic cavity and their external openings are very close. However, they function as totally separate systems. (The female reproductive system is discussed in a separate unit.)

THE URINARY SYSTEM

Objectives

Upon completion of this module, you should be able to:

1. Identify and describe the location and anatomical structure of the kidneys.
2. Identify and describe the major functions of the kidneys.
3. Identify and describe the location, structures, and functions of the urinary bladder, ureters, and urethra.
4. Describe the process of urine formation.

The kidneys are the major organs of the urinary system. They lie against the back abdominal wall (retroperitoneal) at about the level of the twelfth ribs, or a little higher than the normal waistline. Large pads of fat provide the kidneys' only anchoring and protecting structures. A kidney (strangely enough) resembles a very large kidney bean; it is about five inches long from top to bottom and weighs about five ounces. (See Figure 1.) The inner curve serves as the entry spot for various vessels, among them the renal (kidney) blood supply. Within the kidney there are two layers: the cortex, the outer layer, makes up about half the bulk of each organ, and the medulla, or inner layer, the other half. The two layers can be distinguished by sight. Fine lines or striations mark the medulla, converging upon the inner curve. Here they join with the extensions of a large collecting duct. This funnel-like duct is the pelvis of the kidney. It can be several inches wide at its broadest point, but narrows into a thin tube called the ureter that curves down from each kidney.

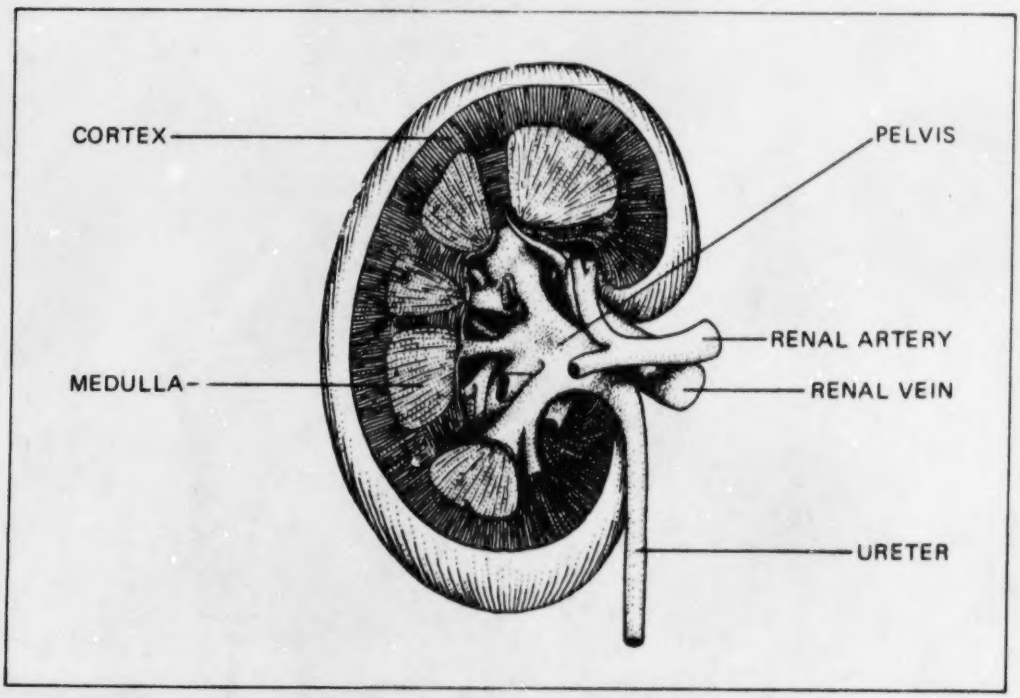


Figure 1. Cross-section of a Kidney

The functional units of the kidney are the nephrons. A nephron is a microscopic filtration unit; there are over a million of them in each kidney. Several structural components give each nephron its filtering capabilities. A tiny, dense bush of capillaries called the glomerulus provides the nephron with slow-moving blood for filtration. A hollow casing called the Bowman's capsule encloses each glomerulus. The Bowman's capsule extends into a long, thin, twisting tube. The twists of the tube each have different functions in the process of filtration, and so have different names; proximal convoluted tubule, loop of Henle (with a descending and an ascending portion), and the distal convoluted tubule. The distal convoluted tubules empty into a collecting tubule that passes through the medulla and empties into the renal pelvis; they form the striations of the medulla. Figure 2 shows the structure of a nephron.

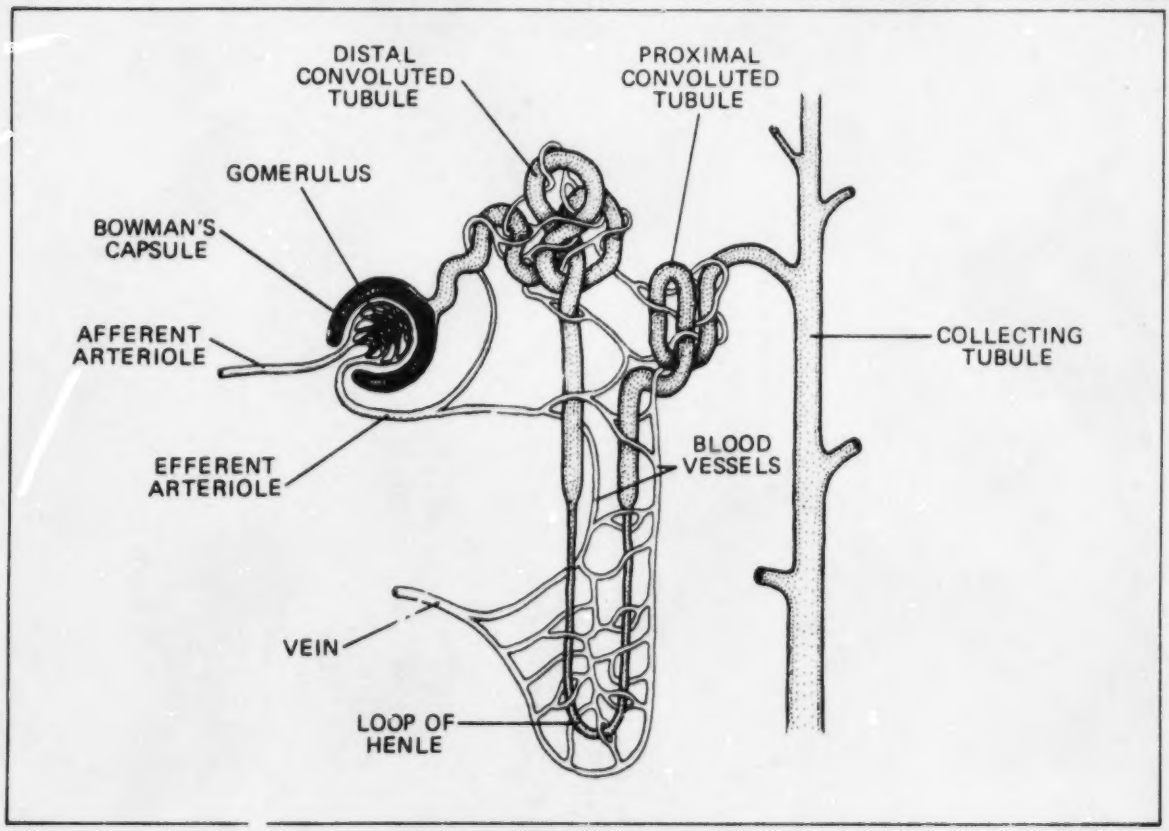


Figure 2. The Nephron

Urine formation takes place in the nephrons of the kidneys. Blood moves slowly through the glomerulus, the tiny bed of capillaries in the Bowman's capsule. The walls of the glomerular vessels are far more porous than normal capillary walls. Water and various dissolved substances filter passively out of the glomerulus and

collect in the Bowman's capsule. From there the filtered liquid (filtrate) moves through the nephron tubules. Active mechanisms in various parts of the tubules remove usable substances from the filtrate: glucose, vitamins, electrolytes, and so on. These enter the capillaries that surround the tubules, and so return to the circulating blood. The medulla of the kidney has a very high sodium content compared to the level of this substance in the filtrate. This sodium draws water out of the filtrate by the process of osmosis. About 99% of the filtrate water is pulled into the medulla and reabsorbed by the capillaries around the tubules. The rest of the water forms the urine. The filtrate has become urine by the time it reaches the collecting tubules at the end of the nephron. Urine consists of water, electrolytes, protein wastes such as urea, and traces of other substances not needed by the body.

The basic function of the kidneys is excretion, a process that entails continual filtration of the blood. For this reason the kidneys are supplied with a massive amount of blood, and can process up to four hundred seventy-five gallons of it in a single day. Without filtration by the kidneys, the blood would very quickly become overloaded with toxic levels of metabolic wastes. But random filtration could deplete the blood of necessary components. The kidneys, however, have remarkable powers of selectivity. They return to the circulation those substances that have been filtered out, but which are still necessary to the body. The waste materials, dissolved in water, become urine. Urine is the end product of filtration, and the substance that is excreted by the kidneys and eliminated by the system.

The kidneys, then, cleanse and replenish the blood. But this is not their only role. Their powers of selectivity in waste removal extend to water removal as well. The kidneys excrete greater amounts of water when there is more water than necessary in the body. When the body needs to conserve water, the kidneys reclaim water from the filtered products. The reclaimed water re-enters the blood where it becomes once again available to the body. (The hormones ADH and aldosterone, which are discussed in the unit on the endocrine system, control the selectivity of water excretion.) Thus the kidneys help regulate the water balance of the body. The body's electrolyte balance is also affected by the kidneys because their concentrations depend on the amount of water in the body.

Another function of the kidneys is to help regulate the acid-base balance of the body. Metabolic processes can occur only if the body fluids are within a certain acid-base range. A simple controlling mechanism is the excretion of any excess acid or base substance. Other mechanisms, such as buffer systems, exist to prevent acid-base shifts. Buffers are substances that enter the blood to regulate the acid-base balance of body fluids. The kidneys excrete or conserve selected amounts of the buffer substances; their activity maintains the proper proportions of buffers and thus the body's proper acid-base balance.

These various balances in the body must be constantly maintained within specific limits or body functions will become impaired. The kidneys, in their capacity to select what and how much they excrete, help regulate many of these delicate and important balances.

The remaining organs of the urinary system dispose of the urine excreted by the kidneys. Urine collects in the renal pelvis and funnels into the ureters, which then conduct it down for storage in the bladder. The pelvis of each kidney curves downward and then narrows into a long tube, the ureter. The two ureters extend down the rear wall of the abdomen for about twelve inches, from the kidneys to the urinary bladder. The ureters are made up of smooth muscle tissue within a fibrous covering. The smooth muscle contracts slowly in wave-like motions to push urine toward the bladder. This motion is called peristalsis. The ureters enter the floor of the urinary bladder from behind. The bladder sits low in the pelvic cavity, directly in the back of the pubic bone. It is a small, bag-like organ which is capable of a great deal of stretching. The smooth bladder floor is triangular in shape, and tilts downward at its front corner. Folds of smooth muscle lined by mucous membrane make up the bladder walls. These walls unfold and expand to hold incoming urine. The bladder begins to stretch with about a pint (250 ml) of urine, but it can hold much more. The functions of the bladder are to store the urine excreted by the kidneys, and to help expel it from the body.

Urine leaves the body through a thin tube called the urethra. The urethra of the female extends only a short distance from the floor of the bladder to the external opening--about an inch and a half. It passes behind the pubic bones to an opening between the clitoris and the vagina. The urethra of the male is about eight inches long. It extends from the bladder through the prostate gland, where it joins with the ejaculatory ducts of the reproductive system. It then passes beneath the pubic bone and into the penis; its external opening is at the tip of the penis. The urethra of the male also functions as the passageway for sperm from the reproductive system, but urine and sperm do not mix.

The urethra has two sphincters: the internal sphincter where the urethra meets bladder, and the external sphincter. These structures are muscles that circle the urethra and remain in a constant state of contraction. When contracted, the sphincters clamp down on the urethra to prevent urine leakage. Smooth or involuntary muscle makes up the internal sphincter; the external sphincter, however, can be voluntarily controlled.

The process of eliminating urine from the body (urination or voiding) is fairly simple. The urine drips into the renal pelvis of the kidney and down the ureters to the urinary bladder. The bladder streches to contain and store the urine, and to prevent internal pressure that would drive it back up the ureters. Nerve cells that are sensitive to stretching (stretch receptors) are scattered throughout the bladder walls. Various reflexes alert the central nervous system when there is enough urine in the bladder to stimulate the stretch receptors. This brings about a conscious realization--which can be ignored for a while--of the need to urinate. In the act of urination, the external sphincter voluntarily relaxes, the internal sphincter relaxes by reflex, and the smooth muscle of the bladder contracts, forcing the urine out of the body.

OPTIONAL ACTIVITIES

- Research the process of dialysis by an artificial kidney machine.
- Describe the diagnostic tests perfomed on urine. What conditions do they indicate?
- Describe the effects of electrolyte imbalance.
- Explore other mechanisms of acid-base balance regulation.

THE MALE REPRODUCTIVE SYSTEM

Objectives

Upon completion of this module, you should be able to:

1. Identify and describe the location, structures, and functions of the testes.
2. Describe the structure and functions of the male reproductive system.
3. Identify and describe the location, structures, and functions of the male reproductive accessory glands.
4. Describe the structure and functions of the penis.

The male reproductive system consists of those organs that produce the male reproductive cells or spermatozoa (sperm) and introduce them into the female reproductive system. The testes form the sperm; the duct system transfers the sperm from the testes through the penis; and the penis deposits the sperm within the female body. There are also several accessory glands and organs, all of which contribute to the total functioning of the reproductive system. Figure 3 shows the organs of the male reproductive system.

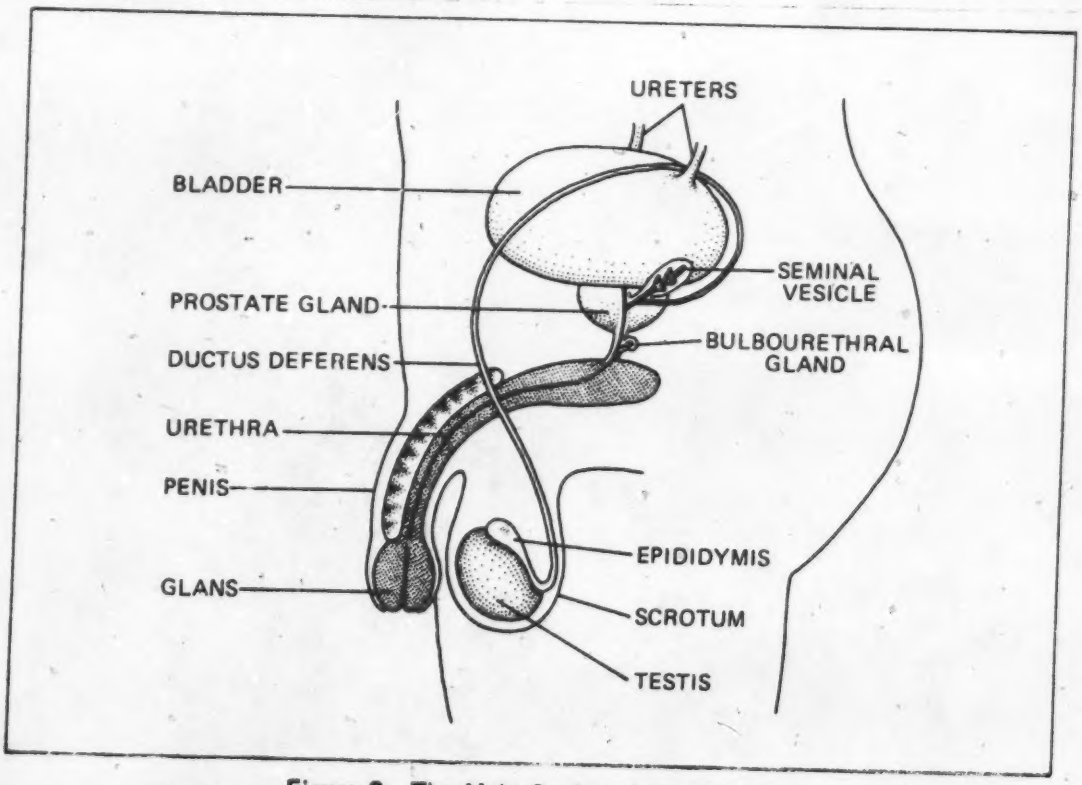


Figure 3. The Male Genitourinary Organs

The testes are the primary male reproductive organs; the rest of the reproductive system serves to store and transfer the products of the testes. The testes, or testicles, are located in the scrotum. This is a loose sac of skin that is attached to the abdomen at about the level of the pubic bone, behind the penis. The external location of the testes is important. Viable sperm cannot be formed at body temperature. The testes could not function if they were located inside the abdomen. The scrotum keeps the temperature of the testes cool enough for sperm formation to take place. The testes themselves are two small oval bodies. A layer of tough connective tissue serves as a protective covering inside the scrotum, and also penetrates into each testis to divide it into many tiny sections. Each section contains a seminiferous tubule. There are about 400 of these tubules in each testis. The seminiferous tubules are microscopic, coiling tubes which join together to form a duct. The tubules contain millions of sperm cells, in various stages of development, and cells which provide nourishment for the sperm. Interstitial cells, or the cells of Leydig, lie between the seminiferous tubules. These cells secrete the androgens, or male hormones. (Their activities are more fully discussed in the unit on the endocrine system.)

The testes have only two functions: spermatogenesis, or the production of mature sperm; and the secretion of the androgens, principally testosterone. Sperm cells are produced in the seminiferous tubules; they are shaped like long, thin, microscopic tadpoles. Sperm cells possess ability to move (called motility). The head of the sperm cell contains the reproductive material which fertilizes the female ovum. Unlike the female's ova, sperm are produced by the millions, on a constant basis, in the testes.

The sperm, to fulfill their function, must get from the testes to the female reproductive system. This is the purpose of the duct system. The duct system begins with the epididymis. (All of the ducts of the system are paired, except the urethra.) The epididymis is the duct into which the seminiferous tubules empty. It is a thin, long, close-spiraling tubule that joins up with the testis and then curves around it and up toward the abdomen. Smooth muscle tissue composes the inner walls of the epididymis, and a tough casing covers the outside. The epididymis leads into the ductus deferens, which is also called the vas deferens. Although this duct is also made of smooth muscle, it is thicker and less twisted than the epididymis. It extends up the side of the scrotum and in front of the pubic bone. Here the ductus deferens would be very vulnerable to injury were it not for the spermatic cord which sheaths it. This structure is a thick and extremely tough tube of fibrous connective tissue. It extends from the scrotum up into the abdomen, and protects not only the ductus deferens but also various nerves and blood vessels. The ductus deferens extends back into the abdomen over the bladder, and curves down behind the bladder to join the ejaculatory duct, a small tube that connects the ductus deferens to the urethra. The two ejaculatory ducts join with the last duct of the system within the prostate gland. This final duct is the urethra, which serves as the outlet for the sperm.

The duct system has two major functions: it provides a space for storing the constantly-produced sperm (the epididymides especially serve as storage tubes) and the duct system is also the means of transferring the sperm from the gonads to the penis, and out of the body. Smooth muscle in the duct walls aids in this function by

strong, rhythmic contractions at the appropriate time. This forces the sperm out of the system under pressure (ejaculation). A minor function of the duct system is the production of part of the seminal fluid, the fluid which contains the sperm. The epididymides secrete some components of the seminal fluid.

Most of the seminal fluid is secreted by the male reproductive accessory glands, the seminal vesicles, the prostate gland, and the bulbourethral glands. The seminal vesicles are two small, sac-like structures which lie at the base of the bladder where they join the ductus deferens and the ejaculatory ducts. The inside surfaces of the seminal vesicles are lined with secreting membrane. Much of the thick, sticky component of the seminal fluid is produced by this membrane. The secretions of the seminal vesicles nourish the sperm cells in storage and in transit. The vesicles empty into the ejaculatory ducts.

The prostate gland is another secreting organ. It sits directly beneath the bladder, and is trisected by the ejaculatory ducts and the urethra. It is about the size of a walnut, but shaped more like a doughnut, with the urethra forming the central hole. The prostate is made up of secreting tissue, and produces the largest percentage of the seminal fluid. The fluid it secretes is alkaline. This is important, because sperm motility is greatest in an alkaline environment. The urethra and the vagina are both fairly acidic. The secretions of the prostate gland protect the sperm from the effects of this acidity, and preserve their motility.

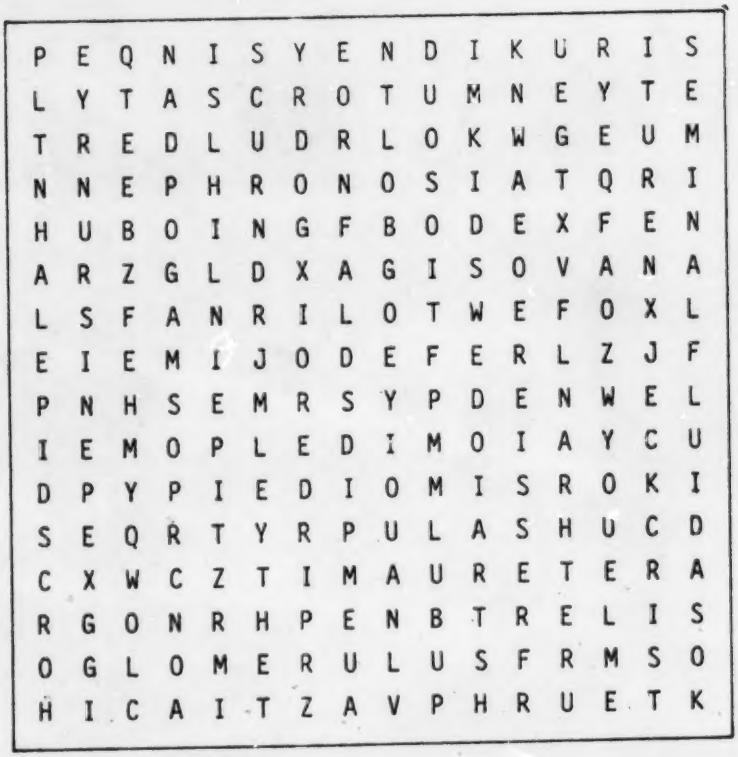
The two bulbourethral glands, or Cowper's glands, are the last secreting glands in the duct system. They sit directly beneath the prostate, one on either side of the urethra. These glands are only about the size and shape of peas. They make a small contribution to the seminal fluid, through ducts that empty into the urethra. The secretions of these glands, like those of the prostate, are alkaline.

The penis has several special structural properties that are essential to its function. Externally it consists of the long shaft ending in the glans, which is slightly thicker. At birth the glans is covered by the foreskin. The foreskin is sometimes surgically removed through the process of circumcision. Internally, the penis is made up of three separate tubes of tissue. Each of these tubes is encased in its own fibrous sheath, which does not stretch much. This relative inelasticity gives the penis its erectile property. Sexual stimulation causes the blood to fill the penile arteries. Since there is only so much room within the fibrous sheathing, the penile veins tend to flatten. Thus they cannot drain the penis of incoming blood and the organ becomes rigid. This condition is known as erection. The penis in its erect state is able to penetrate the vagina and deposit sperm within the female reproductive system. This is its main reproductive function. The sperm are released (some 400 million at a time) in a reflex action known as ejaculation, with the help of the smooth muscle of the reproductive system ducts.

OPTIONAL ACTIVITIES

- Find out the reasons for, techniques, and effects of the following procedures: vasectomy, prostatectomy, orchidectomy, circumcision.

OPTIONAL ACTIVITY



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N	N	E	P	H	R	O	N	O	S	I	A	T	Q	R	I
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H	I	C	A	I	T	Z	A	V	P	H	R	U	E	T	K

Find the following terms in the word maze above. Words may appear forwards, backwards, vertically, horizontally, or diagonally.

kidney
urethra
glomerulus
seminal fluid
nephron
testes
epididymis
scrotum
sperm
ureter
penis

GLOSSARY

androgen:	a substance that produces male characteristics, such as the male sex hormone, testosterone.
buffer system:	a system of acids and bases that work to maintain a constant pH.
bulbourethral glands:	(also Cowper's glands) two small accessory glands of the male reproductive system which secrete a part of the seminal fluid.
ductus (vas) deferens:	the tubes which convey sperm from the testes to the ejaculatory duct.
ejaculation:	the forcible ejection of sperm and seminal fluid from the penis.
ejaculatory duct:	the tube that joins the ductus deferens to the urethra.
epididymis:	a twisted, tubular duct of the testes that conveys sperm to the ductus deferens.
glomerulus:	a small, round mass of capillaries that makes up part of a nephron.
homeostasis:	the state of constancy of proper balances within the body.
interstitial cells:	cells within the testes that secrete testosterone.
kidneys:	the two major organs of the urinary system which filter the blood and produce urine.
nephron:	the microscopic functional unit of the kidneys.
osmosis:	the passage of a solvent (usually water) through a membrane.
penis:	the male organ of copulation and urination.
prostate gland:	a male reproductive accessory gland which surrounds the urethra at the base of the bladder. It secretes seminal fluid.
renal:	pertaining to the kidney.

scrotum:	a sac of skin that hangs from the base of the penis and contains the testes.
seminal fluid:	the thick, sticky fluid which contains the sperm.
seminal vesicles:	two male reproductive accessory organs which secrete part of the seminal fluid.
seminiferous tubules:	coiling tubes of the testes which produce and transport sperm.
spermatic cord:	the cord that suspends the testes and contains and protects the ductus deferens, blood vessels, and nerves.
spermatogenesis:	the formation of mature sperm.
spermatozoa:	(sperm) the male sex cells.
sphincter:	a circular muscle that narrows an opening when it contracts.
testes:	the primary male reproductive organs; they produce sperm and testosterone.
ureters:	the two tubes which transfer urine from the kidneys to the bladder.
urethra:	the tube which conducts urine from the bladder to the exterior; it also conducts sperm in the male.
urinary bladder:	a bag-like organ that stores urine.
urinary ducts:	tubes that conduct urine; the ureters and urethra.
urine:	the waste fluid formed in the kidneys and excreted by the urinary system.

The Genitourinary System
POST-TEST

1. Name the urinary ducts which transfer urine from the kidneys to the bladder.

_____

2. Which of the following is a major function of the urinary system?

A. producing metabolic wastes
B. filtering the blood
C. protecting the kidneys
D. producing electrolytes

3. The major organs of the urinary system that filter the blood and produce urine are the two:

_____.

4. Name the two organs that are shared by the reproductive system and the urinary system in the male.

_____

_____

5. Which of the following best describes the relationship between the female reproductive system and the female urinary system?

A. They perform many similar functions.
B. There are two organs shared by both systems.
C. Both systems produce and secrete hormones.
D. The systems are located very near each other.

6. The kidneys are located on the back wall of the:

   A. chest.
   B. abdomen.
   C. stomach.
   D. thorax.

7. The striated inner layer of the kidney is the:

   _____.

8. The pelvis of the kidney is a:

   A. collecting duct.
   B. filtration unit.
   C. blood vessel.
   D. buffer system.

9. An important function of the kidneys is maintenance of the body's:

   A. metabolic rate.
   B. hormone production.
   C. water balance.
   D. protein intake.

10. The outer layer of the kidney is called the:

    A. nephron.
    B. cortex.
    C. pelvis.
    D. medulla.

11. The bag-like organ that stores urine is the:

    A. urethra.
    B. ureter.
    C. bladder.
    D. glomerulus.

12. The length of the urethra in the female is about how many inches?

A. 1 1/2 inches
B. 5 inches
C. 8 inches
D. 12 inches

13. Urine formation takes place in what microscopic units of the kidneys?

_____

14. What is the main function of the urinary bladder?

_____

15. The two circular muscles that surround the urethra are the internal and external:

_____.

16. The dense bed of capillaries located within the nephron is the:

A. loop of Henle.
B. glomerulus.
C. convoluted tubule.
D. collecting tubule.

17. In the process of urine formation, most of the water and vital minerals filtered from the blood are:

A. excreted.
B. acidified.
C. buffered.
D. reabsorbed.

18. List the two major functions of the testes.

_____

_____

19. The testes are contained within the:

A. penis.
B. seminiferous tubules.
C. scrotum.
D. prostate gland.

20. Which of the following are the male reproductive cells?

A. spermatozoa
B. seminal vesicles
C. ova
D. epididymides

21. The small tube that connects the ductus deferens to the urethra is the:

_____.

22. Name the two major functions of the male reproductive duct system.

_____

_____

23. The major function of the male reproductive accessory organs is the production and secretion of:

A. hormones.
B. urine.
C. sperm.
D. seminal fluid.

24. What male reproductive accessory organ surrounds the urethra and ejaculatory ducts?

_____

25. Secretions of the male reproductive accessory organs provide the sperm with what type of environment?

A. alkaline
B. corrosive
C. acidic
D. neutral

26. The bulbourethral glands are also known as:

_____.

27. The process of surgically removing the foreskin of the penis is called:

_____.

28. The main reproductive function of the penis is to:

A. serve as an outlet for urine.
B. introduce sperm into the female's vagina.
C. provide lubrication for intercourse.
D. initiate the production of sperm.

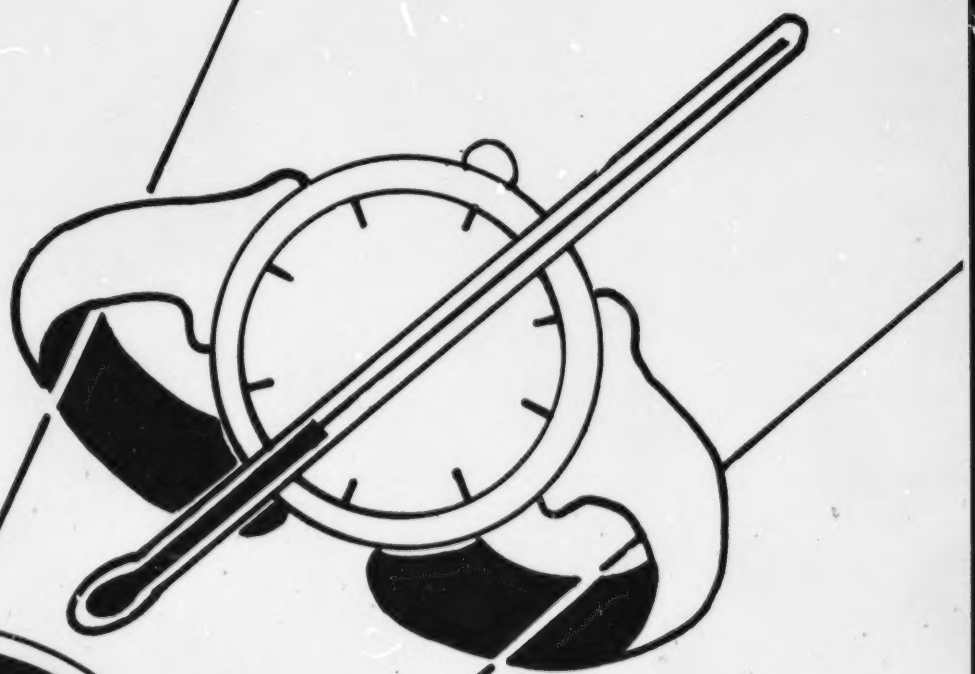
29. The rigid condition of the penis that allows penetration of the vagina is:

_____ _____.

30. Sperm is forcibly expelled from the penis through the process of:

_____.

HEALTH OCCUPATIONS EDUCATION MODULE



INSTRUCTOR'S GUIDE: THE GENITOURINARY SYSTEM

Instructional Materials in Anatomy and Physiology
for Pennsylvania Health Occupations Programs

INSTRUCTOR'S GUIDE:

THE GENITOURINARY SYSTEM

Prepared for:

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June, 1980

INTRODUCTION

These instructional modular units have been developed for the Pennsylvania Department of Education for use in vocational education programs. They were designed on the assumption that a basic understanding of human anatomy and physiology is essential to any person preparing to enter a health care occupation such as practical nursing, nursing assistant, medical assistant, emergency medical technician, or dental assistant. Each of these modular units will cover the most important aspects of one of the major systems of the human body. In the first four units the following systems are covered: circulatory system, respiratory system, musculoskeletal system, and digestive system. In the second four units, the endocrine, reproductive, nervous, and genitourinary systems are covered.

This Instructor's Guide is designed to provide suggestions on how to use a modular unit most effectively in your instruction. These recommendations, however, do not represent the only way to use these units: you may be able to devise more beneficial uses for the materials.

THE MODULAR UNITS

Each modular unit is made up of several components: a pretest, three to six instructional modules with optional activities for the students, a glossary of terms used in the unit, and a post-test. Each of these components has a specific purpose and is organized in a specific way, as explained in the following sections.

Pretest

After reading the preface, which is simply an introduction to these instructional units, students working through a modular unit should first take the pretest. Their answers should be written on a separate piece of paper labeled "Pretest" (they should not have access to these answers when taking the post-test). As its name

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implies, this test is designed to be taken by the student before beginning work on the materials contained in the unit. Its purpose is twofold: (1) to stimulate interest in the modular unit by giving the student a preview of the topics covered, and (2) to provide information to the instructor on what students do and do not know, before and after working through the unit. Based on the student's performance on the pretest, the instructor may wish to emphasize those areas of the modular unit which may require special attention and extra effort on the part of the students. Instructors should score the pretests after the students have completed them, but should not share these scores with the students. After completing the unit, students will then take the post-test (which involves all of the questions on the pretest, and more). Instructors may then compare post-test scores to pretest scores in order to evaluate the amount that students have learned from the unit.

Instructional Modules

This modular unit is composed of three separate but closely related modules, including: Introduction to the Genitourinary System, The Urinary System, and The Male Reproductive System. After taking the pretest, students should read through and study each of the instructional modules. For the students' benefit, each module begins with a statement of the objectives that a student should have mastered upon completion of that particular module. The level of achievement of these goals is measured by students' performance on the corresponding section of the final post-test. The language level and content of each module is aimed toward students seeking an introduction to the components, structures and functions, and the basic terminology required for an understanding of the genitourinary system. However, some material may be too technical or otherwise inappropriate for certain programs. Instructors are urged to use their judgment to determine if any areas are too difficult and should be omitted.

Optional Activities

Following many modules are optional activities intended to provide the student with an opportunity to pursue the content of the module at a more in-depth level. Many of these activities may require teacher participation, at least in obtaining and preparing additional materials for students to utilize.

In addition to the optional activities available, you may choose to provide further information to the students by teaching a brief unit on the common disorders of the genitourinary system. Discussion of these disorders has not been included in

the text because a basic knowledge of the proper structure and function of the human body in a healthy individual seems more appropriate for the purposes of an introductory program. If you do choose to discuss common disorders, the most effective approach may be one in which you use disorders to illustrate what can go wrong in the body, as a means of clarifying the students' understanding of how the body works when functioning properly.

You may also wish to provide students with the names of books or articles as suggested readings to further their understanding of a particular area.

Glossary

After the last of the modules in the unit is a glossary. This is not intended to be a comprehensive glossary to be used by students as a dictionary. Rather, it includes the basic terms used in the unit which are necessary to an understanding of the system covered. Those underlined words which appear in the modules and have been defined in the text are not always defined in the glossary. Some of these particular terms have been used in the module because they are essential but difficult terms needed to explain the content taught in the unit. Students should use the glossary to review the vocabulary essential to the unit before taking the post-test.

Post-Tests

The post-test is the final assessment of a student's understanding of the material presented in each module. It consists of multiple-choice and open-ended questions designed to measure a student's mastery of the objectives stated at the beginning of each module. Each of the questions has been written to measure an aspect of the skills and/or knowledge that a student may be expected to acquire as a result of working through a particular unit. The post-test includes the questions used in the pretest, which can be used for before-and-after comparisons; and it includes additional difficult questions which measure knowledge of subjects treated specifically in the modules.

SCORING THE POST-TESTS

As previously mentioned, the purpose of the post-tests is to measure whether or not a student has mastered the objectives stated at the beginning of each module. Due to the variety of ways in which teachers may choose to utilize these modules, and discrepancies among students' previous exposure to the subject matter, it is not practical to set a standard cut-off score on the post-test that would indicate mastery of the objectives. Rather, teachers are asked to use their professional judgment in individual cases to determine if a student's performance on the post-test indicates that he or she has mastered the objectives stated for the modules. In making this determination, you should consider at least all of the following factors:

(1) How long is the post-test?

(2) How much information is included in each module and how complex is the information, relative to other modules?

(3) Has the student been exposed to the kind of curricular material before? That is, has the student been taught the basics of this system of the body before?

(4) Should the entire class be required to achieve a certain score in order to pass, or should each student be considered individually? (This depends on how and with whom you use this module as instructional material.)

(5) Should the student be graded pass/fail on mastery of objectives in each module, or on the unit as a whole?

To facilitate the scoring of the post-test, each student will record his or her answers on one separate sheet of paper. You should first mark each answer correct or incorrect. Then give the student a "pass" or "fail" on each module by counting the questions answered correctly, or score the unit as a whole by adding up all of the correct answers.

Because of the subject matter, responses to open-ended questions may vary slightly from those provided, but these responses may also be acceptable. Again, in these cases instructors are asked to use their professional judgment to determine if a response is correct.

In order to compare the students' scores on the pretest and post-test, review the scores each student achieved on the pretest, then total the score students achieve on these same questions appearing in the post-test. (Please note: these questions have been placed in different sequence and renumbered; both their old and new numbers are listed in the answer key.) You may wish to compare the students' scores on the entire set of items which appears in both tests, or on the items for each module, or on each item individually. Whichever approach seems most useful can be accomplished by using the information given.

On the following page is a list of answers to the pretest and post-test questions, which is provided to facilitate the grading of your students' papers.

ANSWER KEYS

Pretest

1.	kidneys	6.	B	11.	A
2.	urethra, penis	7.	urine storage	12.	ejaculatory duct
3.	ureters	8.	C	13.	D
4.	C	9.	B	14.	prostate gland
5.	nephrons	10.	sperm production, hormone secretion	15.	ejaculation

Post-test

NOTE: Starred question numbers indicate those questions which also appeared on the pretest. The pretest number of each repeated question is given in parentheses. Post-test questions 1-5 refer to materials presented in module 1, Introduction to the Genitourinary System; questions 6-17 refer to module 2, The Urinary System; and questions 18-30 refer to module 3, The Male Reproductive System.

*	1.	(3)	ureters	*11.	(4)	C	*21.	(12) ejaculatory duct
	2.		B	12.		A	22.	sperm storage, sperm transfer
*	3.	(1)	kidneys	*13.	(5)	nephrons	*23.	(13) D
*	4.	(2)	urethra, penis	*14.	(7)	urine storage	*24.	(14) prostate gland
	5.		D	15.		sphincters	25.	A
*	6.	(9)	B	16.		B	26.	Cowper's glands
	7.		medulla	17.		D	27.	circumcision
	8.		A	*18.	(10)	sperm production, hormone secretion	28.	B
*	9.	(8)	C	19.		C	29.	erection
*	10.	(6)	B	*20.	(11)	A	*30.	(15) ejaculation